

ASTEROID SURFACE PROCESSES: EXPERIMENTAL STUDIES OF THE SOLAR WIND ON REFLECTANCE AND OPTICAL PROPERTIES OF ASTEROIDS.

Lucy-Ann McFadden, California Space Institute-0216
University of California, San Diego, La Jolla, CA 92093-0216

The effect of the solar wind on the optical properties of meteorites is being studied to determine whether the solar wind can alter the properties of ordinary chondrite parent bodies resulting in the spectral properties of S-type asteroids. We are analyzing the existing database of optical properties of asteroids to determine the effect of solar wind in altering asteroid surface properties. Justifications include: Previous models of the effects of solar wind on asteroids have not included sputtering, previous studies of solar wind bombardment on lunar materials can be built upon and expanded, problems of laboratory simulation of the solar wind are currently better known than in the past and can be overcome. New analytical techniques are available to determine the physical and chemical changes due to solar wind, increasing the potential to understand the processes producing the observed optical properties. The structure of the solar wind in the asteroid belt is different than that used in simulations at the Moon. The asteroid database has not been systematically examined since the 1970's. Analysis of asteroids near the 3:1 Kirkwood gap measured in the near-infrared between 0.8-2.5 mm has proceeded to the point of manuscript preparation (Figure 1). We have reviewed literature on the nature of the solar wind and theories and experiments relating to solar wind alteration of the lunar surface. A topical reference index using Hypercard on a Macintosh Computer was created by an undergraduate working for the summer of 1990. We investigated sample set-up methods using the ion-bombardment equipment in Robert Johnson and John Boring's laboratory at the University of Virginia and planned our measurement protocol. The first chemical analyses on our samples have begun. Within the next year we will apply a sputtering model to asteroids, and measure the optical properties of forsterite olivine and three ordinary chondrite meteorites (an H, L, LL), bombard them with 1-3 KeV protons simulating the solar wind at doses simulating both ambient solar wind over time, and high velocity, high density streams. We will measure the neutral and ion mass spectrum above the sample using a Scanning Electron Microprobe at the surface of the sample before and after bombardment to document the physical-chemical changes independently of the optical properties. Measurements of the optical properties of the bombarded samples will be made. We will compare the results with existing asteroid optical

properties to evaluate the validity of the current working assumption used to interpret optical properties of asteroids: that asteroids are represented by unaltered, powdered meteoritic material. This research represents the beginning of a collaboration bringing together expertise from the areas of asteroid geology and geophysics, atomic physics, and analytical chemistry.

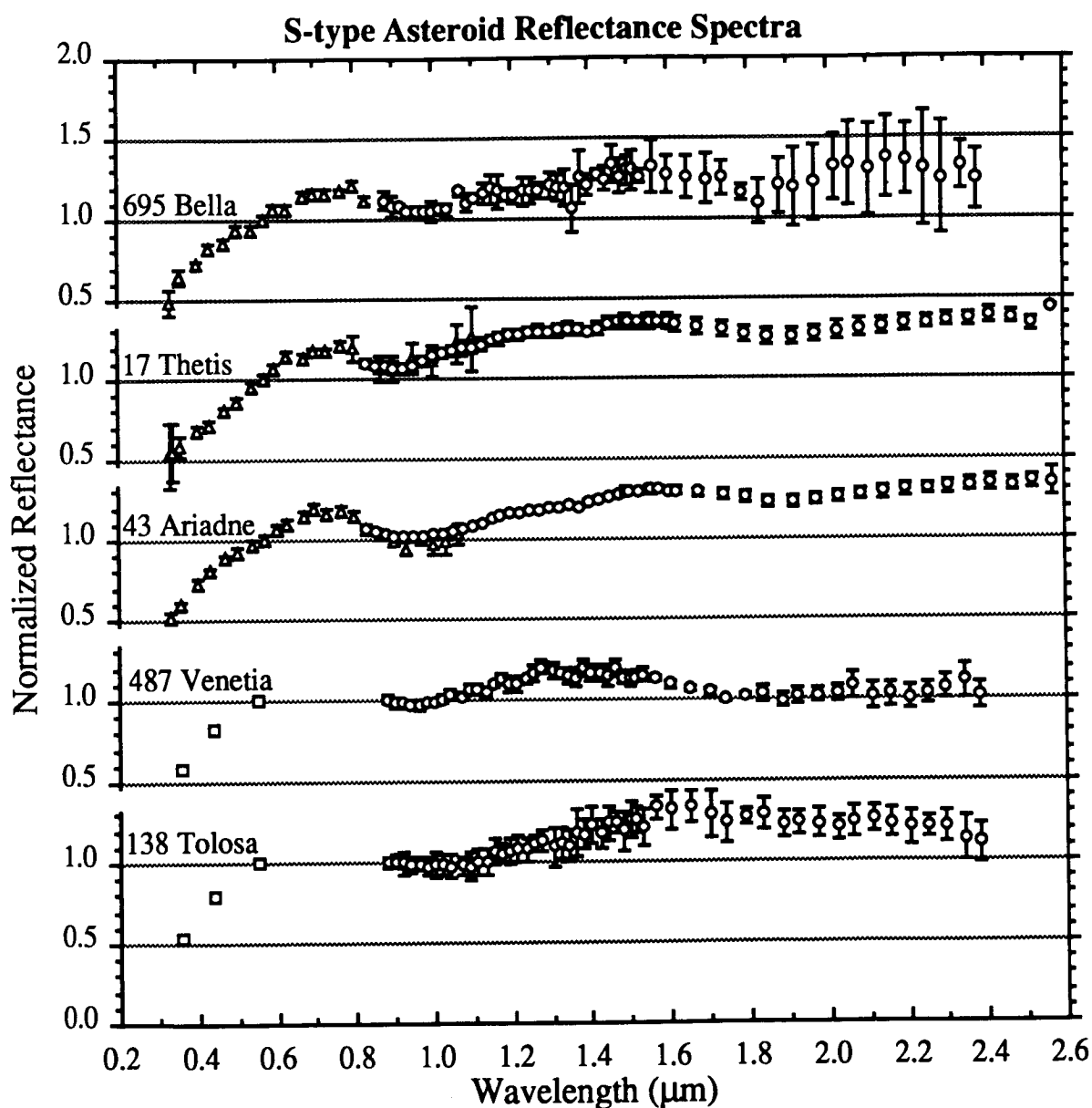


Figure 1: Near-IR reflectance spectra of S-type Asteroids. Laboratory studies will enable us to explain the differences in IR reflectance values.